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which the natural crystalline form of the alloy would have been presented in a single crystal."

Dr. Engelmann gave additional accounts of the peculiarities, classification, and geographical distribution of the *Cactaceæ* of the United States.

President Hitchcock exhibited a model representing the shape of the masses of snow which fell at Brattleborough, Vermont, on the 24th of May last. The masses were all alike, and in the form of a cone with a concave base, of about a quarter of an inch in diameter, and of a pretty firm consistence, — about that of an ordinary snow-ball.

Four hundred and thirty-second meeting.

November 12, 1856. — QUARTERLY MEETING.

The PRESIDENT in the chair.

Professor Agassiz stated that he had recently been engaged in the study of a number of fishes of Greece, which he had received from his friend, Dr. Roeser, through the agency of Professor Felton, which led him to identify the Glanis of Aristotle.

"There are several classes of the animal kingdom, respecting the habits of which most of the information stored up in our scientific records is derived from the observation of men of little education engaged in the labors of common life. This is particularly the case with the fishes. The importance of fisheries at all times, and the value of fish as an article of food, have made it necessary for those interested to ascertain all that can be known respecting the habits of fishes, in order that they may the more successfully pursue their occupations. If we look over all the works on ichthyology written down to the present day, or any more general works in which the fishes are included, a critical reader will very soon perceive that the remarks relating to the habits of fishes are for the most part made on the authority of the fishermen. Cuvier justly says, that to his day no man knew the fishes of the Mediterranean more accurately than Rondelet, — that classic sea, surrounded from the most ancient times by civilized nations interested in fisheries, fond of fish as an article of

food, carrying the luxury so far as to have them brought alive upon their table, to enjoy the beautiful sight of the changing of their colors in the struggles of death ; and yet every page of his work shows that most of his information respecting the habits of fishes was borrowed from his intercourse with fishermen. The works of Aristotle furnish frequent evidence that his own information upon this class of animals, as far as their habits were concerned, had a similar foundation. But he, as all great naturalists of all times, sifted the reports, sought for more information where it seemed needed, and related only what he knew could be depended upon, however marvellous some of his statements may seem at first sight. There are many facts of this kind related in the works of Aristotle, which have excited considerable doubt, and even led to suspicions respecting the general trustworthiness of his assertions. There are a few passages in his works which have even been questioned more directly. Such is his mention of the habits of the Glanis, in the following passages : —

“ ‘ The fresh-water fishes spawn in the still waters of rivers and lakes among the reeds, as the Phoxinos and the Perke. The Glanis and the Perke give out their spawn in a continuous string, like the frogs ; and indeed the spawn is so wound up that the fishermen reel it off, at least that of the Perke, from the reeds in lakes.

“ ‘ The larger Glanis spawns in deep waters, some at the depth of a fathom ; the smaller in shallower places, especially among the roots of willows or some other tree, and also among the reeds, or the mosses. They copulate, sometimes a very large with a very small one, and bringing the parts together which some call the navel, and through which they discharge the seed, the females the eggs, and the males the sperma. All the eggs that are mingled with the sperma become generally on the first day white and larger, and a little later the eyes of the fishes become visible. These at first, in all fishes, as also in all animals, are early conspicuous on account of their size. And those of the eggs that the sperm does not touch, as in the case of the sea-fishes, are useless and sterile. But in these fertile eggs, as the fishes grow larger, a kind of husk separates. And this is the envelope that encloses the egg and the young fish. When the sperm has mingled with the egg, the spawn becomes more viscous among the roots, or wherever it may have been deposited. And where the greatest quantity is deposited, the male guards the eggs, and the female, having spawned, departs. The growth of the Glanis

from the egg is very slow, wherefore the male keeps watch forty or fifty days, that the young may not be devoured by the fishes that happen to be in their neighborhood.’*

“‘Of the river fishes, the male Glanis takes great care of its young. For the female, having brought forth, departs; but the male, where the greatest deposit of eggs has been formed, remains by them watching, rendering no other service except keeping off other fishes from destroying the young. He does this for forty or fifty days, until the young are sufficiently grown to escape from the other fishes. And he is known to the fishermen wherever he may chance to be watching his eggs; for he keeps off the fishes by rushing movements, and by making a noise and moaning. And he remains by the eggs with so much of natural affection, that the fishermen, when the eggs adhere to deep roots, bring them up to the shallowest place they can; but he does not even then leave his offspring, but if he chance to be a young fish, he is easily taken by the hook, because he snaps at all the fishes that approach him; but if he is already accustomed to this, and has swallowed hooks before, he does not even then desert his young, but breaks the hook by a very strong bite.’†

“Cuvier, alluding to these passages in the great *Histoire Naturelle des Poissons*, which he published in connection with Valenciennes, makes the following remarks respecting the fish called Glanis by Aristotle, and its habits:—

“‘It cannot be doubted that our Silouros is the *Γλάνς* of Aristotle. Besides that it is common in Macedonia, and still bears in Turkey the name of *Glanos* or *Glano*, what the philosopher states concerning his *Glanis* agrees well enough with our Silouros, so far as we know its history; the disturbance that stormy weather causes him, the slow development of the eggs, their size, the care he takes of them, the noise he makes, &c.

“‘It is possible that at a certain period the name Silouros, which Aristotle does not employ, may not have been the synonyme of Glanis. For in a passage of Ælian, where the Glanis of the Strymon [misprinted in Cuvier’s work Shymon] is mentioned, the Glanis of Aristotle is compared with the Silouros. Perhaps this name belonged originally to some of the species of Egypt or Syria; but

* Aristotle, Hist. An., Lib. VI. c. xiii. §§ 2–6.

† Lib. IX. c. xxv. § 6.

what is also very certain is, that, in another passage, Ælian applies this name to our Silouros of the Danube ; and Pliny makes the same application, and even employs it in translating the very passages of Aristotle.*

“ ‘ What Aristotle relates in detail, and in two passages, of the care which the male Silourus takes of the eggs of the female, borders on the marvellous. According to him, the large Silouri deposit them in deep waters ; the smaller among the roots of willows and other trees, among the reeds or even the mosses. The female, having laid them, leaves them, but the male guards and defends them ; and as the eggs are long in developing, he continues this care forty or fifty days.’ †

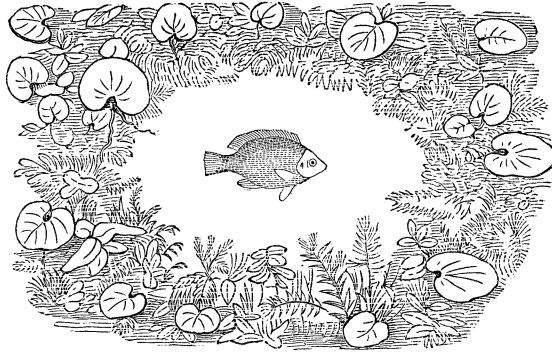
“ Within the last ten years, much unexpected information has been collected by naturalists themselves, no longer borrowed from indirect observation, but ascertained while tracing their embryonic growth. Among these investigations, none has attracted so much attention as that of Coste, who observed that the Sticklebacks of Europe build a very neatly constructed nest, in which the eggs are deposited, the parents sitting upon and watching by them until the young are hatched. This fact, however, had already been noticed more than thirty years ago, and recorded in the *Isis* of Oken. Von Martens had made similar observations upon a species of *Gobius*, found in the Lagunes of Venice. But from want of sufficiently minute illustrations, these facts hardly attracted notice, until the full and extensive accounts of Coste, accompanied with numerous drawings, not only removed all doubt respecting the care which some fishes take of their progeny, but revived extensively the interest in such investigations.

“ Since I have been in the United States, my attention has been particularly directed to this subject, again and again, by the numerous reports which have reached me, that there are in this country several species of fishes which take care of their young in a similar way, belonging to the genera *Catostomus*, *Exoglossum*, *Pomotis*, and *Pimelodus*. Of *Exoglossum* and *Catostomus* I have had no opportunity thus far to observe the habits with sufficient minuteness to ascertain which of the numerous species of the latter genus takes such care of its young, and in what way this is performed ; but it is reported of *Exoglossum*, that

* Cuvier, *Histoire des Poissons*, Liv. XVII. c. 1, Vol. XIV. pp. 344, 345.

† Ibid. pp. 350, 351.

they carry little stones to build heaps, among which the eggs are laid; and this species is commonly called *Stone-toters* (carriers of stone). But I have had ample opportunity to watch the *Pomotis* in the breeding season every spring for the last eight years. At that time it approaches in pairs the shores of the ponds in which it lives, and selects shallow, gravelly places, overgrown with *Potamogeton*, water-lilies, and other aquatic plants, in which it begins by clearing a space of about a foot in diameter, rooting out the plants, removing, with violent jerks of its tail, the larger pebbles, carrying away with its mouth the coarser gravel, and leaving a clean spot of fine sand, in which it deposits its eggs, surrounded and overshadowed by a grove of verdure as represented in the following wood-cut. In



this enclosure one of the parents remains hovering over its brood, and keeping at a distance all intruders. The office of watching over the progeny does not devolve exclusively upon either of the sexes, but the males and females keep watch alternately. The fierceness with which they dart at their enemies, and the anxiety with which they look out for every approaching danger, show that these are endowed with stronger instincts than have been known heretofore in any of their class. Their foresight goes so far as to avoid the bait attached to any hook, however near it may be brought to them, and however lively and tempting it may be. *Pomotis* do not build their nest singly; hundreds of them may be seen along the same shore, within very small distances of one another, forming, as it were, temporary settlements, two nests sometimes hard by each other, or only separated by narrow partitions of water-plants. However near to one another, the pair of one nest do not interfere with those of another,

but like good neighbors they live peacefully together, passing over each other's domain when going out for food without making any disturbance. But whenever an unmated single fish makes its appearance among the nests, he is chased away like an intruding libertine and vagabond. The development of the egg is very rapid. In less than a week the young are hatched, and the parents soon cease to take any further care of them.

"*Pimelodus catus* I have had fewer opportunities to watch. However, I have seen them in the spring, which, in the latitude they inhabit, does not fairly set in before the end of May, approach the shores of our ponds, like *Pomotis*, in pairs, and clear also a space among the low water-grasses, *scirpus*, and the like, in very shallow water, not more than a foot or so in depth, and deposit its eggs in the same manner as *Pomotis*, and watch as carefully and vigilantly over its progeny. Yet I have not been able to ascertain how long the period of incubation lasts. But at different times I have seen the young already hatched, still hanging about within the area of the nest, protected by their watchful parent: sometimes the male and female remaining together with them; at other times, either one or the other of the old fish keeping watch alone. I have seen larger broods of young, already three fourths of an inch, and even an inch long, remaining together like a flock, around one or the other of the parents; and sometimes both swimming slowly in the centre or by the side of what, at some distance, would appear like a black cloud rolling slowly through the water in one or another direction, but which, seen more closely, proves to be a flock of young fish. I have observed such flocking broods through the whole month of June, and noticed that in each the young were of larger and larger size in the latter part of that month, until they swim more loosely, and finally disperse half together; the parents standing nearer the flock, or even in its centre, in proportion as the fish are smaller. When watching over the eggs which are not yet hatched, or when following the young brood, the old fish seem very solicitous for the safety of their progeny, and drive away with great fierceness any approaching enemy. I have even seen one dart at a little hand-net which I was dipping in the water, to secure the young which were still hovering over their nest.

"Having thus far become familiar with the mode of reproduction of *Pimelodus*, the statements of Aristotle relating to the *Glanis* of Greece, which is another representative of the same family of *Silu-*

roides, were brought back to my mind with increased interest. The correctness of the facts related by the great Stagirite respecting that fish could no longer be doubted, as soon as it had been ascertained that another member of the same family has habits so nearly similar to those of the fish of Hellas. There was, moreover, a particular charm in the prospect of confirming the reports of a philosopher of classic Greece, by investigations made in a country so recently covered with the primitive forest, and roamed over by the native tribes of Indians. I availed myself with eagerness, therefore, of the opportunity afforded by Professor Felton's visit to Greece to obtain, if possible, fresh-water fishes from that country, to ascertain by direct comparison what the Glanis of Aristotle really is. Though I had no longer reason to doubt the facts reported by the ancients respecting its mode of reproduction, I was not prepared to believe that Cuvier is correct in considering the Glanis as identical with the Silurus of Central and Eastern Europe, even though the opinion expressed by Cuvier is that entertained also by Pliny, and the naturalists of the Middle Ages; * for I have been acquainted with the Silurus from my boyhood; I was brought up on the shore of a lake where it is common, where fishing is practised on an extensive scale, and where I have myself spent weeks and months in the delightful, lazy, and enticing pursuit; and yet I have never heard nor seen anything respecting that Siluroid which could apply to the Glanis of Aristotle. I wrote by Professor Felton a letter to my old friend, Dr. Roeser, first physician to their majesties, the king and queen of Greece, requesting him to spare no efforts in procuring for me fresh-water fishes from that country, in the hope of thus obtaining the means of ascertaining by actual inspection the true character of the Glanis. Some time after, I received from Dr. Roeser a very fine collection of well-preserved specimens from the Eurotas, the Ache-

* Ælian (Nat. An. XII. 14) does not confound the two: "The Lagnis (Glanis) is found in the Mæander, the Lycus, and other Asiatic rivers, and in Europe, in the Strymon; and resembles the Silurus in appearance. Of all fishes it has the most natural affection for its young. When the female has laid her eggs, she is relieved of all care of the young, like one in childbed; but the male, taking his post as the guardian of his offspring, stands by them, keeping off every assailant. He is capable even of swallowing a hook, as Aristotle relates."

Pliny (IX. 52), however, makes the mistake: "The male Silurus alone watches the eggs when laid, often even fifty days, that they may not be destroyed by others";—thus transferring Aristotle's description of the Glanis to the Silurus of Central Europe.

lous, and the Spercheios, to which were appended labels with the local names under which they are known to the Greek fishermen at the present day. A more interesting collection than this I have seldom had an opportunity to examine. In it were half a dozen specimens labelled Γλανίδια (*Glanidia*), caught in the Achelous, the chief river in Acarnania, from which locality Aristotle himself had derived his information about the *Glanis*. The identity of the name and of the place leave no doubt that I am now in possession of the true *Glanis* of the Greek philosopher; that this *Glanis* is a genuine Siluroid, but not the *Silurus Glanis* of the systematic writers.* It is a distinct

* The following quotations will sustain these assertions:—

“The Cordylus swims with its feet and its tail; and it has a tail like the *Glanis*.”
— Aristotle, Hist. An. I. 5. 3.

“Of those that have gills, some have simple gills and some have double; but the last, nearest the body, is in all cases simple. And some have few gills, others have many, but all have an equal number on both sides. Those that have the fewest have one on each side, but that double, as the Capros; others have two on each side, one simple, the other double, as the Conger Eel and the Scarus; others have four simple ones on each side, as the Elops, the Synagris, the Muraena, and the Eel; and others still have four, but in two lines, except the last, as the Kichle, the Perke, the *Glanis*, the Cyprinos.” — Ibid. II. 9. 4.

“Of those belonging to the sea, and having lungs, the dolphin has no gall-bladder; but all birds and fishes have the gall-bladder, the egg-laying, the four-footed, and, to speak generally, sometimes more, sometimes less. But some of the fishes have it on the liver, as the Galeodes, the *Glanis*, the Rhine, the Leiobatos, the Narke; and of the lung fishes, the Enchelys, the Belone, and the Zygæna.” — Ibid. II. 11. 7.

“The river and lake fishes are exempt from pestilential disease, but some of them have peculiar disorders, as the *Glanis*, which, about the time of the dog-star, by reason of swimming on the surface, becomes sun-struck, and is stupefied by loud thunder; and many *Glanides* in shallow water perish by the bite of snakes.” — Ibid. VIII. 20. 12.

These passages show, that,—1. The anal fin of the *Glanis* of Aristotle has the form of the *Glanidia* of the Achelous. 2. The description of the gill agrees equally with those of the specimens in my possession. 3. The presence of the gall-bladder in the position described is another point of agreement. 4. The connected spawn of the Siluroid differs from the isolated eggs laid by many other fishes, as, for instance, the Salmonidæ. 5. The swimming near the surface agrees fully with what is observed among Siluroids in hot weather. So every statement of Aristotle relating to his *Glanis*, either agrees with the structure observed in the specimens obtained from Acarnania, or, as far as the habits are concerned, with the mode of spawning of the North American *Pimelodus*, with perhaps the single exception, that the account of Aristotle is more minute than any statements that could at this moment be made respecting our fishes of that family.

The passages here given contain all that Aristotle has said of the *Glanis*.

genus, closely allied to *Silurus* proper, of which I shall take an early opportunity to publish a detailed description, with figures, under the name of *Glanis Aristotelis* : and thus, though at this late day, vindicate once more the accuracy of the greatest naturalist of the ancient world.

“The great work of Cuvier and Valenciennes, *Histoire Naturelle des Poissons*, contains all that was currently known about the class of fishes up to the time of its publication. The learned authors of this extensive book, which, though unfinished, numbers not less than twenty-two volumes, have not only described all the fishes they could obtain themselves, but also sedulously collected all the information that may be gathered from earlier writers, and even referred the statements of the ancients relating to these animals to their respective species, as far as this could be done. That work is therefore as truly a model of scientific erudition, as it is a standard for all future investigations upon the class of fishes.

“These remarks are made chiefly with the view that I may not appear to disparage a scientific production which is destined to stand the test of time, because I happen to have it in my power to rectify some statements respecting the *Silurus Glanis* contained in that work.

“Strange condition of modern culture, which makes it possible for an inhabitant of the United States to contribute to the elucidation of the works of Aristotle, written more than two thousand years ago, and to vindicate the accuracy of that great naturalist by observations of a similar character made upon the inhabitants of the fresh waters of a continent, the existence of which was not even suspected by the Greek philosopher.”

Professor Felton remarked, that he had some acquaintance with the fishes of Greece, but chiefly in other than their scientific relations. He rose, however, not to speak of science, but to make a few philological remarks.

“The communication of Professor Agassiz is extremely interesting in every point of view. It is a very striking fact, that the fish in question should, so many centuries after the death of Aristotle, have come from the Achelous across the Atlantic to this country, to furnish our associate with a commentary on the great philosopher, and to vindicate his accuracy as an observer against the criticism even of a Cuvier.

“ There can be no doubt of the identity of this fish with that whose habits are described by Aristotle, under the name *Γλάνις*. The ancient names of birds, fishes, and quadrupeds, in numerous instances, are preserved among the common people, under forms modified in the same way as other classes of words are by the uneducated. The oblique cases are often used, as is common in other languages among the ignorant, for the nominative; in other instances, diminutives are formed from the roots, as exhibited in the oblique cases, and used in the sense of the original word. The name in Aristotle is written *Γλάνις*; the local name still preserved among the fishermen, in the same region, in the North of Greece, is *Γλανίδι*, formed, according to numerous analogies, from the genitive *Γλάνιδος*; and the plural of *Γλανίδι* (*Γλανίδιον*) is *Γλανίδια*, the word employed in the catalogue accompanying the specimens. Thus the fish sent from Acarnania to Athens, and from Athens to Cambridge, to find a place in Professor Agassiz's collection, though dumb, has spoken a noble eulogy upon the greatest philosopher of the ancient world.

“ There is a close connection, as Cicero long ago observed, a *commune vinculum*, between all departments of learning. This instructive fish has not only corrected Cuvier, but the Greek lexicographers, who must take a lesson of him, and change their definition. Pape, who is generally very accurate, defines *Γλάνις* as ‘eine Art Wels,’ *a kind of cat-fish*, which is tolerably near the truth; and Liddell and Scott, the translators of Passow, call it *a kind of shad*. Hereafter the shad must give place to *horn-pout*, a substitution less displeasing to the lexicographer than to the epicure.”

Dr. B. A. Gould acknowledged, in the name of Argelander, his election as Honorary Member, and offered as an apology in his behalf, for not directly addressing the Academy, his inability to write English with facility.

Dr. O. W. Holmes exhibited a section of a Hemlock which had recently fallen on his estate at Pittsfield. The section was made at the height of twelve feet, and by its rings showed its age to be at least three hundred and forty-six years, dating back to 1510. The section exhibited the usual inequality of growth at different periods in the varying width of its rings. Dr. Holmes made the specimen interesting, by indicating at different points the epoch of the birth and death

of some of the great lights of English literature, comparing the existence of each with the few inches of growth of the tree, exhibiting in striking contrast the shortness of man's earthly career. Some conversation ensued on the popular notion that, under certain circumstances of external condition, more than one ring might be formed in a single year.

Professor Gray regarded all such opinions as erroneous, or at least not based on any reliable observations. So far as is known, in temperate climates, all ordinary woods make one annual ring; the fact has not as yet been determined so decidedly in the case of tropical trees. Young trees grow more rapidly and unequally than old ones, and hence an inequality in the width of the rings.

Professor Agassiz said that Mr. H. J. Clark had recently noticed that in the climbing Dogwood (*Rhus Toxicodendron*) the side of the branches resting on any opposing object becomes thickened by an increased development of the rings on that side.

Professor Gray said he had observed this unequal growth in the same plant in old stems of the plant, but had not noticed it as bearing any relation to any circumstances of position. Such anomalies are common in climbing plants, particularly in those of southern and tropical climates. Mr. Clark had shown him very young stems of *Rhus*, in which the same irregularity existed without any reference to position. The fact is, that, after the first year, the woody layer fails to be formed on one side of the stem, and that too on the free and convex side, not on that which is flattened by pressure against the supporting object, as would have been expected. Mr. Clark has promised to investigate this anomalous growth more particularly.

Dr. B. A. Gould stated, that in Texas it had been pointed out to him, that trees grow most on the south side; and the circumstance was depended upon at times by hunters to direct their path.

Professor Gray observed that such facts are well known, as

trees habitually grow most on the side on which the most favoring influences predominate. On the sea-coast the trees naturally grow most freely on the land side.

The following gentlemen were elected Resident Fellows, viz. : —

Professor Henry W. Torrey of Cambridge, in Class III., Section 3.

Rev. N. L. Frothingham, in Class III., Section 4.

Benjamin A. Gould, in Class III., Section 2.

E. A. Sophocles, in Class III., Section 2.

Dr. C. H. F. Peters, in Class I., Section 2.

Henry James Clark, in Class II., Section 3.

Four hundred and thirty-third meeting.

December 9th, 1856. — ADJOURNED QUARTERLY MEETING.

The Academy met at the house of the President. The President in the chair.

The Corresponding Secretary read letters from the Rev. N. L. Frothingham, accepting the Fellowship; from the Imperial Academy of Sciences, Vienna, March 10th and April 15th, acknowledging the receipt of the Academy's publications; from the Zoölogical and Botanical Association, Vienna, May 10th; the Royal Society of Sciences at Upsal, November 16th, 1855; the Royal Prussian Academy of Sciences, Berlin, March 6th; the Natural History Association of the Prussian Rhine Countries and Westphalia, Bonn, January 12th; the Imperial Geological Society, Vienna, March 20th; the Imperial Academy of Sciences, Vienna, May 23d and July 16th, presenting their various publications; from the Society of Physics and Natural History, Geneva, March 11th, in acknowledgment of the receipt of the Academy's publications, and presenting its own, with a circular, offering the fifth annual botanical prize on the foundation of De Candolle.

The President read a paper on the probable cause and nature of the death of Pliny the Elder, taking the ground, in